

# EVA Suitport Project

Advanced Exploration Systems Program | Human Exploration And Operations  
Mission Directorate (HEOMD)



## ABSTRACT

Suitports replace or augment the traditional airlock function of a spacecraft by providing a bulkhead opening, capture mechanism, and sealing system to allow ingress and egress of a spacesuit while the spacesuit remains outside of the pressurized volume of the spacecraft. This presents significant new opportunities to Extravehicular Activity (EVA) exploration in both microgravity and surface environments.

## ANTICIPATED BENEFITS

### To NASA funded missions:

Should the ISS be able to isolate an area to 8 psi and install a suitport, short, rapid EVAs could replace the 16 hour EVA days experienced now. However, to realize this benefit, the crew would have to live for long periods of time at 8 psi, which is not currently supported by ISS.

### To NASA unfunded & planned missions:

The EVA suitport has the potential to change the way NASA considers EVA. A functional suitport on an 8 psi spacecraft may allow simple EVAs to "go out and check something", instead of the rigorously planned, full day efforts we have now. Single person EVAs may become acceptable, since the IVA crewmember would still be able to provide assistance within 30 minutes. This different way of performing EVAs would allow for frequent EVAs, which may support the scientific objectives of future exploration missions. Suitports may also reduce crew fatigue and injury (hot spots) by allowing the crewmember to do more frequent, shorter EVAs. The suitport technology could be used on future small spacecraft, such as rovers, to help minimize the vehicle size and mass as compared to using an airlock.



EVA Suitport

## Table of Contents

Abstract . . . . .	1
Anticipated Benefits . . . . .	1
Detailed Description . . . . .	2
Technology Maturity . . . . .	2
Management Team . . . . .	2
Technology Areas . . . . .	2
U.S. Work Locations and Key Partners . . . . .	3
Image Gallery . . . . .	4
Details for Technology 1 . . . . .	5

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## DETAILED DESCRIPTION

The suitport concept will enable three main improvements in EVA by providing reductions in: pre-EVA time from hours to less than thirty minutes; airlock consumables; and contamination returned to the cabin with the EVA crewmember. Suitports capitalize on the Atmospheres Working Group recommendation of an 8 psi and 32% cabin environment for exploration spacecraft. The reduced cabin pressure allows the suitport and the suit to be exposed to full cabin pressure while maintaining a lightweight, EVA-friendly design.

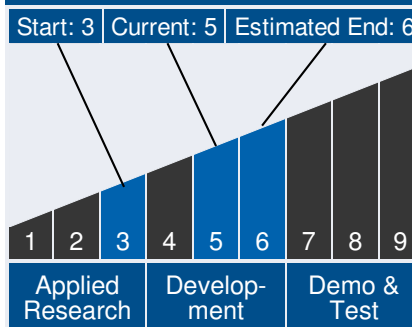
Two different designs for a suitport were built and tested: the Marman and Pneumatic Flipper suitports. Two generations of Marman suitports have been tested with mockup suits on rover cabins. These tests have demonstrated the ability of test subjects to dock and undock from the suitport and have helped define the operational concepts and timelines, demonstrating the potential of suitport to save significant amounts of crew time before and after EVAs.

The first generation Marman suitport has also been tested pressurized on a bench top engineering unit which has successfully demonstrated the pressurizable seal concept including the ability to seal after the introduction and removal of contamination (such as dust/soil) to the sealing surfaces.

The second generation Marman suitport and the first generation Pneumatic Flipper suitport have also been tested with a spacesuit prototype using the pressure differentials of the spacecraft. The test was performed using the JSC B32 Chamber B, a human rated vacuum chamber. This test demonstrated the first ever pressurized donning and doffing of a rear entry space suit through a suitport.

Suitport operations rely on the Advanced EVA project to design the advanced suit in a suitport-compatible manner, which

### Technology Maturity



### Management Team

#### Program Executive:

- Mark Lee

#### Program Manager:

- Jason Crusan

#### Project Managers:

- Robert Boyle
- Liana Rodriggs

#### Principal Investigator:

- Robert Boyle

### Technology Areas

#### Primary Technology Area:

Human Exploration Destination Systems (TA 7)

#### Secondary Technology Area:

Human Health, Life Support, and Habitation Systems (TA 6)

└ Extravehicular Activity Systems (TA 6.2)

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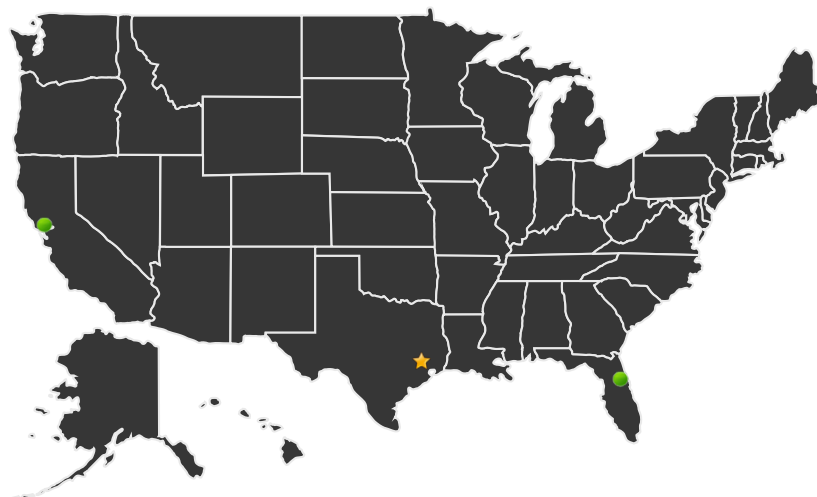


presents significant challenges. The suit must add a SuitPort Interface Plate (SIP) and withstand harsher storage environments. Life support system interfaces must be plumbed to the front of the suit to insure operation when installed in the suitport. The components of the life support system must be packaged to support this plumbing configuration and to allow for hinging of the life support backpack for rear-entry donning and doffing of the suit.

### Technology Areas (cont.)

**Additional Technology Areas:**  
Human Health, Life Support, and  
Habitation Systems (TA 6)

### U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States  
With Work

★ **Lead Center:**  
Johnson Space Center

- **Supporting Centers:**
- Ames Research Center
  - Kennedy Space Center

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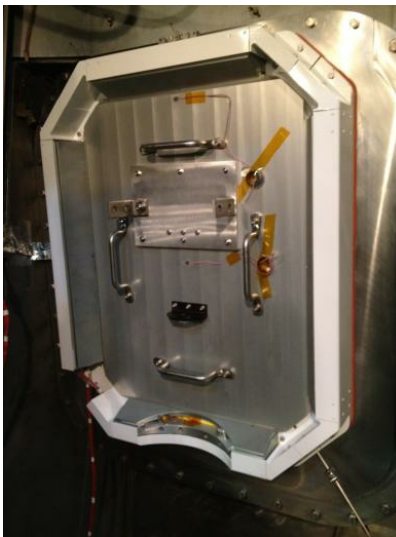
### Other Organizations Performing Work:

- ILC Dover
- Jacobs Engineering

### IMAGE GALLERY



*Z-1 Suit with SIP on Pneumatic Flipper  
Suitport in Chamber B*



*Pneumatic Flipper Suitport in Chamber  
B*



*Donning the rear-entry suit through the  
Suitport*

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*Test subject undocks from Marman  
Suitport mounted to a rover vehicle*

## DETAILS FOR TECHNOLOGY 1

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### Technology Title

EVA Suitport

### Technology Description

This technology is categorized as a hardware system for manned spaceflight

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### Capabilities Provided

EVA Suitport provides rapid EVA beyond the current NASA experience base. This technology could change EVA from a long burdensome day, to something where an exploration crew member could "pop out" and get a rock and be back in the spacecraft for lunch.

### Potential Applications

This technology has application to human exploration missions, both microgravity and planetary surface.

### Performance Metrics

Metric	Unit	Quantity
EVA Overhead - EVA Prep Time	Minutes	From ~ 4 hrs to < 30

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Completed Project (2011 - 2012)

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### Performance Metrics (*cont.*)

Metric	Unit	Quantity
EVA Consumables - Overboard gas	Pounds of gas lost per EVA	from ~ 11 to < 1
Contamination introduced into cabin	Percent Reduction	75%